

## 90934 Demonstrate understanding of aspects of chemical reactions

### Collated questions on Synthesis/Combination reactions 2011-2013

#### Question One

A teacher showed her class two video clips of chemical reactions.

One was of a reaction between sodium metal and chlorine gas. The second was of a reaction between solid sulfur and chlorine gas.

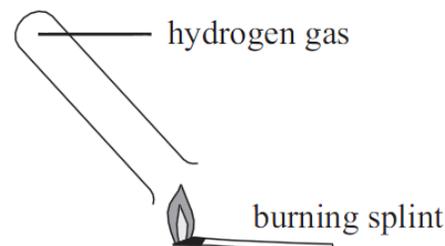
- When the sodium metal reacted with chlorine gas, the video clip showed a shiny grey solid reacting with a yellow-green gas. The reaction resulted in the formation of white crystals.  
Link these observations to the reactants and products involved in this reaction.
- Name the product that will be formed when solid sulfur reacts with chlorine gas.
  - Identify the type of reaction that is occurring, and give a reason for your choice.
- Write a balanced symbol equation for the reaction between sodium and chlorine.
  - Write a balanced symbol equation for the reaction between sulfur and chlorine.
- Explain the differences in the two reactions: sodium with chlorine gas and sulfur with chlorine gas, in terms of electron transfer.

#### Question Two

A teacher demonstrates a reaction between hydrogen gas and oxygen in the air.

Analyse the reaction

- Identify the type of reaction that occurs: Give a reason for your choice:
- Describe any observations that would be made of this reaction, and link these to the substances involved in the reaction.  
Outline a test that could be used to confirm the presence of the product formed.
- Write a balanced symbol equation for this reaction.



#### Question Three

Different elements can be reacted together to form compounds with properties that are different to the original elements.

The reaction of iron and sulfur to form iron(II) sulfide is an example of a combination reaction where all species (reactants and products) have different properties.

Give a detailed account of this combination reaction.

In your answer you should:

- state the conditions required for this reaction to occur
- describe any observations that would be made
- outline the physical and chemical properties of EACH of the species
- explain why the properties of the reactants differ from those of the products
- write a balanced symbol equation for the reaction.

## Answers

### Question One

- (a) Shiny grey metal sodium reacts with yellow / green chlorine gas to form white crystals of sodium chloride.
- (b) (i) Sulfur dichloride or disulfur dichloride or sulfur chloride. (ii) This is a combination reaction because two elements, sulfur and chlorine combine to form a new substance / compound, (di)sulfur dichloride.
- (c)  $2\text{Na}(s) + \text{Cl}_2(g) \rightarrow 2\text{NaCl}(s)$   $\text{S}(s) + \text{Cl}_2(g) \rightarrow \text{SCl}_2(s)$
- (d) Sodium is a metal element and when it reacts with chlorine gas, both elements form ions. Each sodium atom loses 1 electron to each chlorine atom / each chlorine atom gains 1 electron. Sodium ions and chloride ions combine to form the (ionic) compound sodium chloride, NaCl.  
Sulfur is a non-metal element and when it reacts with chlorine gas, electrons are shared. Sulfur and chlorine atoms combine to form the (covalent) compound sulfur dichloride,  $\text{SCl}_2$ .

### Question Two

- (i) This is an example of a combination (accept combustion or oxidation) reaction because two elements react together to form one new compound.
- (ii) The hydrogen and oxygen would explode with a small flame and a loud squeaky pop would be heard. Condensation / colourless liquid (water) would form on the tube.  
Condensation forming in the tube could be tested with  $\text{CoCl}_2$  paper, which will turn from blue to pink.
- (iii)  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

### Question Three

At room temperature, iron and sulfur can be mixed in a beaker as a mixture. Heat is required for the reaction to occur.

Iron: Physical: solid, black / grey, magnetic, metallic properties.

Chemical: 2 electrons to lose so it is relatively reactive.

Sulfur:

Physical: yellow solid, brittle, non metallic properties.

Chemical: reactive due to requiring 2 valence electrons for a stable octet.

Iron sulfide:

Physical: black solid, no longer magnetic.

Chemical: a stable ionic compound.

In the reaction, there is a glow as the sulfur melts and reacts with the iron.

Each Fe atom loses 2 electrons forming  $\text{Fe}^{2+}$ , each sulfur atom gains 2 electrons,  $\text{S}^{2-}$ .

$\text{Fe}(s) + \text{S}(s) \rightarrow \text{FeS}(s)$